Final Report on Technology Innovation Projects for Small and Medium Enterprises

Development of Technology for Environment- and Human-Friendly, Flame-Retardant Coating

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Submitted by YUJINTECH21 Co., Ltd.

Report

To the Commissioner of the Korean Small and Medium Business Administration

We submit this report as a final report on "Technology Innovation Project for Small and Medium Enterprises, relating to Development of a Technology for an Environment- and Human-Friendly, Flame-Retardant Coating"(Time period for research: March, 2003 ~ February 2004.).

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(2) Preparation of flame-retardant coating solution

Flame retardant components are mixed with each other. Then, 30 wt% of unsaturated polyester resin is diluted in 25 wt% of solvent MEK, a dispersing agent is added thereto, and the solution is stirred. Then, to the stirred resin composition, 40 wt% of the above-prepared flame retardant mixture is added and stirred such that it is sufficiently dispersed. To control the dispersion of the coating solution containing the flame retardant mixture, a mill is used to prepare a final flame-retardant coating solution, in which particles have uniform size and are stably dispersed.

Table 7: Composition of flame-retardant solution

Chemical	Amound
Flame retardant	30-40 parts
Binder	20-40 parts
Dispersing agent	5-10 parts
Leveling agent	2 parts
MEK	10-30 parts
Total	100 parts

With regard to flame retardancy at various $Mg(OH)_2$/zinc borate mixing ratios, flame retardancy was not continuously increased with an increase in the content of zinc borate, but rather was reduced when the ratio of zinc borate to $Mg(OH)_2$ was greater than 0.7: 1. The reason for this is that no carbide film was formed during combustion. Specifically, it is considered that an increase in the content of the inorganic flame retardant zinc borate led instead to a decrease in adhesion, so that cracks developed between the coating layer and the substrate, and thus flame retardancy was reduced due

to wide spread combustion, attributable to the supply of inflammable gas during thermal composition.

Table 11: Effects of $Mg(OH)_2$ and zinc borate contents on flame retardancy and adhesion of flame-retardant coating solution

Run	Raw materials	UL-1581 (VW-1)	
	$[Mg(OH)_2]$/[zinc borate]	Adhesion	Flame retardancy
1	1/0.0	Good	Fail
2	0/1.0	Good	Fail
3	**1/0.6**	**Good**	**Pass**
4	1/0.7	Good	Pass
5	1/0.8	Bad	Fail
6	1/0.9	Bad	Fail

For a more excellent flame retardant effect and flexibility, the amount of flame retardant used was reduced to 1/2, and the phosphorus flame retardant AF100 S, which has an excellent flame retardant effect due to the formation of a carbide film, was added at various mixing ratios. Flame retardancy was evaluated while increasing the ratio of AS100 S from 0.2 to 1.0 at a fixed $Mg(OH)_2$/zinc borate ratio of 1: 0.1. The evaluation results are shown in Table 12 below. As shown in Table 6, a flame retardant effect is shown when the ratio of AF100 S : $Mg(OH)_2$: zinc borate is greater than 0.6 : 1: 0.3. The test results showed that the optimal mixing ratio of $Mg(OH)_2$ /zinc borate/AF100 S was 1:0.3:0.6.

Table 12: Effects of AF100 S content on flame retardancy and adhesion of flame-retardant coating solution

Run	Raw materials	UL-1581 (VW-1)	
	$[Mg(OH)_2]$/[zinc borate]/[AF100 S]	Adhesion	Flame retardancy
1	1/0.3/0.2	Good	Fail
2	1/0.3/0.4	Good	Fail
3	**1/0.3/0.6**	**Good**	**Pass**
4	1/0.3/0.8	Good	Pass
5	1/0.3/1.0	Good	Pass